

INSTRUCTION MANUAL
FOR THE
WAVEMETER
TYPE 8905A



MP MASTER



MA25133

BOONTON DIVISION
Hewlett-Packard Company

Green Pond Road Rockaway, New Jersey

U. S. A.

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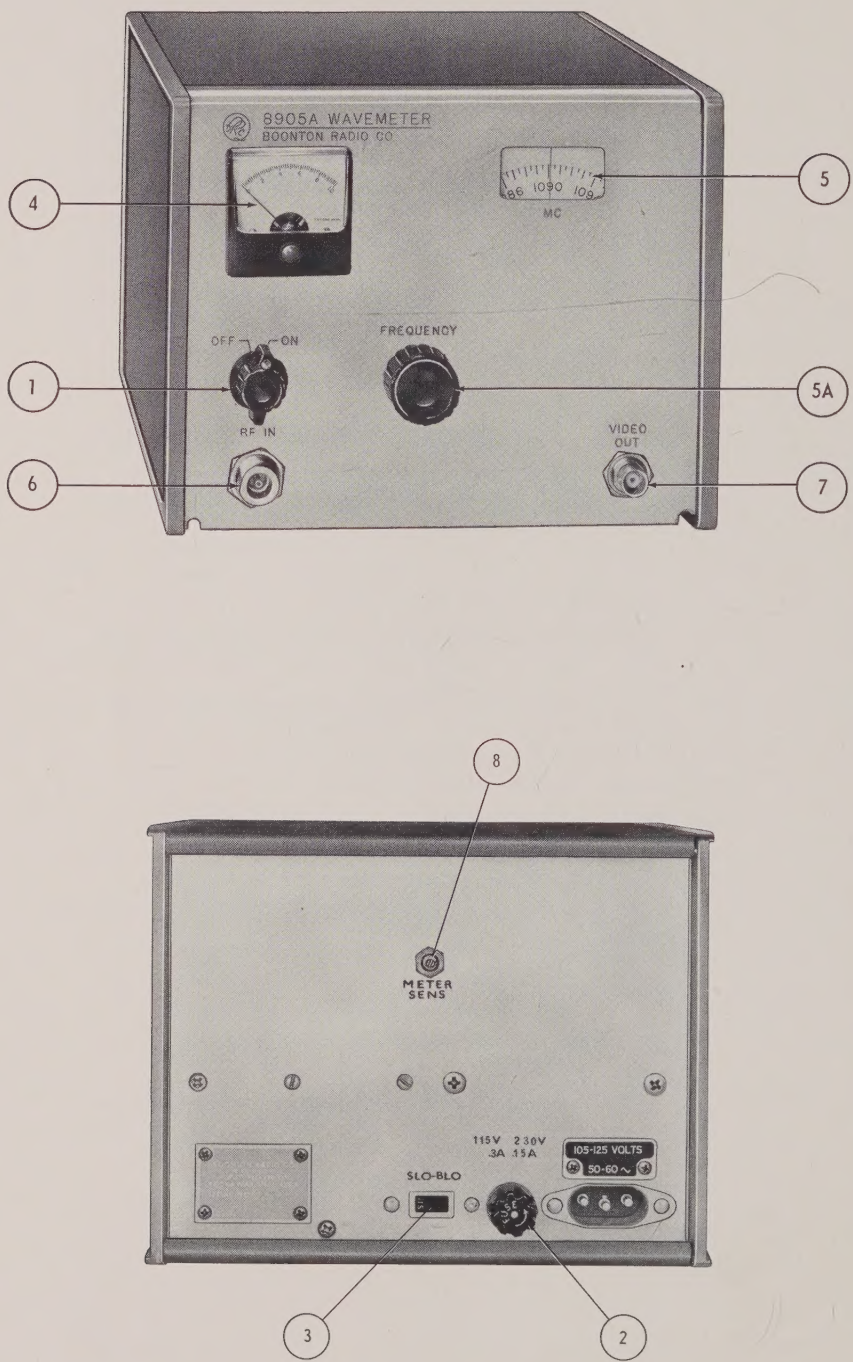


Figure 1. Operating Controls and Layout

SECTION I

DESCRIPTION

GENERAL

The Type 8905A Wavemeter provides a means of measuring the transmitter output frequency of an ATC transponder. This instrument is a resonant cavity, transmission type wavemeter having a frequency range of 1070 mc to 1110 mc in order to accommodate the transponder operating frequency which consists of a pulse spectrum centered on 1090 mc. Accuracy of the wavemeter over the entire frequency range is ± 0.5 mc.

A meter with associated circuitry acts as a resonance indicator for adjusting the frequency dial to the transmitter frequency.

A front panel BNC connector (VIDEO OUT), provides a means for monitoring the demodulated pulse train from the transponder for measuring frequency at levels below the meter limit of 25 mw input.

The wavemeter has its own self-contained power supply.

All active devices in the wavemeter are of a solid state type.

The Type 8905A is completely self-contained and housed in a modular cabinet which can be adapted, using a combining case or rack adapter frame, to standard 19 inch rack mounting.

PANEL LAYOUT AND CONTROLS

A front view of the instrument with its controls is shown in Fig. 1. All of the controls for operation of the 8905A are located on the front panel. Instrument front panel designations (following item name) are shown below within quotation marks. Rear panel designations are shown in parenthesis.

1. Power Switch "OFF-ON"

This switch applies power to the circuits when in the ON position.

2. Fuse

This fuse in the ac line is located on the back panel of the instrument (1/8 amp. for 115 v input, 1/16 amp. for 230 v input).

3. Input Voltage Switch (115-230)

The input voltage switch allows the wavemeter to be operated from a 115 v or 230 v source by sliding the switch to the required position and changing the fuse as indicated under "2. Fuse".

4. Indicator Meter

This meter, calibrated from 0 to 10 indicates resonance when the wavemeter is tuned to the incoming frequency.

5. Frequency Dial "MC"

The frequency dial is calibrated from 1070 mc to 1110 mc in 0.5 mc increments.

5A. Frequency Control "FREQUENCY"

The frequency control operates the frequency dial and the wavemeter tuning circuit.

6. RF Input Connector "RF IN"

The RF signal whose frequency is to be measured is introduced at this female, type N, connector. The maximum average power which may be connected directly to this input is 0.1 watt.

7. Video Output Connector "VIDEO OUT"

The output of this connector is used to monitor the demodulated pulses from the RF detector in the 8905A. An oscilloscope can be used

at this connector for indicating wavemeter resonance at levels below the range of the panel meter (25 to 100 mw).

8. Meter Sensitivity Control (METER SENS)

This control is preset at the factory to provide the proper meter indication over the specified range of input peak pulse power. Should it be desired to have signals of higher than specified peak power (+20 dbm) indicated by the meter, readjustment of the meter sensitivity control can be made to permit indications up to the level of approximately +26 dbm.

SECTION II SPECIFICATIONS

Frequency Characteristics

RF RANGE: 1070 to 1110 mc

RF ACCURACY: ± 0.5 mc

RF CALIBRATION: Increments of 0.5 mc throughout range

RF Input

INPUT PEAK PULSE POWER #

Meter: 25 to 100 mw
(+14 to +20 dbm)

External Indicator: 1 to 100 mw
(0 to +20 dbm)

MAXIMUM AVERAGE POWER: 100 mw (+20 dbm)

IMPEDANCE: 50 ohms

Video Output

OUTPUT: 0.01 v peak minimum for input peak pulse power of 1 mw#

LOAD IMPEDANCE: 150 ohms

Applies for ATC Transponder transmitter reply pulse characteristics as prescribed by ARINC Characteristic No. 532C (3-1-61)

Semiconductor Complement

3 — 2N2712 Transistors

1 — 2N2188 Transistor

2 — 1N1763 Rectifiers

1 — 1N660 Diode

1 — MA425* Diode

1 — 1N36884A Zener Diode

*Manufacturer's part number

Physical Characteristics

MOUNTING: Cabinet for bench use; adaptable for 19 inch rack mounting

FINISH: Gray engraved panel; green cabinet (Other finishes available on special order)

DIMENSIONS: (See Fig. 2)

WEIGHT: Net 10 lbs. (4.5 kg)

Power Requirements

8905A: 105-125/210-250 volts, 50-60 cps

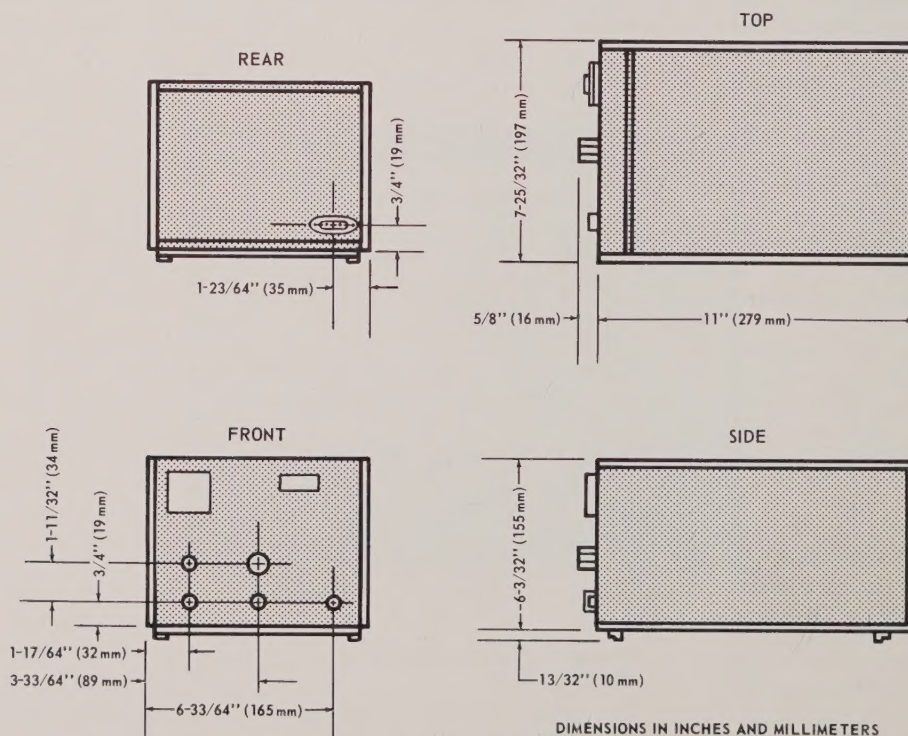


Figure 2. 8905A Dimensions

SECTION III

OPERATING INSTRUCTIONS

NOTE: Where RF peak pulse power levels are referred to throughout this text, they shall be the peak levels of pulses whose characteristics are those of ATC Transponder transmitter reply pulses as prescribed by ARINC Characteristic No. 532C (3-1-61).

INSTALLATION

This instrument may be rack mounted by installing it in a Combining Case (-hp-1052A), which is of standard 19 inch rack dimensions. The 8905A fills one-half of the Combining Case. See Fig. 3. The unused panel space in the case may be filled using a blank panel (available as an accessory to the Combining Case).

Connect the power cord to the power socket on the rear panel of the 8905A. An input voltage switch, mounted above the power socket, may be operated to permit use of either a 105-125 volt or 210-250 volt, 50/60 cps source.

NOTE: The voltage plate on the rear panel should agree with the switch position. Use appropriate fuse as indicated in Section I "2. Fuse".

Connect the power cord to the appropriate source and operate the front panel power switch to the ON position. This instrument requires negligible warm-up time.

CAUTION: Do not apply more than 100 mw average power at the front panel RF IN connector or damage to the instrument may result.

OPERATING PROCEDURE

This instrument is designed primarily to measure the transmitter frequency of an ATC Transponder. This frequency, as specified by ARINC Characteristics No. 532C (3-1-61), is 1090 ± 2.5 mc.

The frequency source to be measured is connected to the RF IN connector on the front panel of the 8905A. The output peak pulse power of the source should be within the limits of 1 to 100 mw (0-20 dbm). (See Section V, Operational Guide

for the measurement of frequency at other power levels.)

Rotate the frequency control slowly while observing the meter. At a peak indication on the meter, the cavity will be tuned to the incoming signal frequency which will be indicated on the frequency dial.

With an incoming signal of less than 25 mw, the meter indication may be inadequate. A sensitive oscilloscope or comparable device connected to the Video Out connector can be used as a tuning indicator for input power levels down to 1 mw.

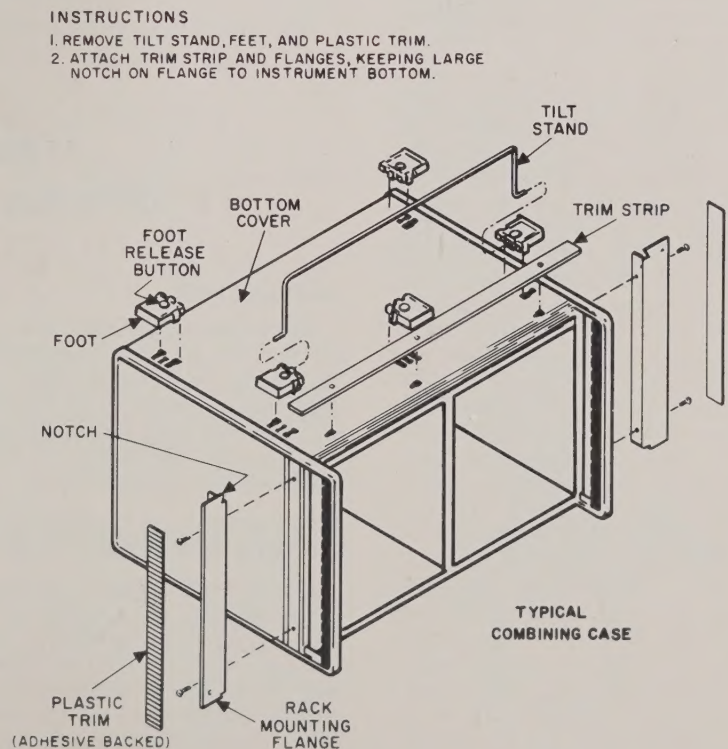


Figure 3. Rack Mounting Instructions

SECTION IV

THEORY OF OPERATION

The 8905A Wavemeter is shown in block diagram form in Fig. 4. It consists of a tuneable wavemeter, an RF detector, a video amplifier, and metering circuitry.

The tuneable wavemeter (A101) is a transmission type device that at resonance passes, with minimum loss, the signal for which it is tuned. The tuning range of the cavity is 1070 to 1110 mc. The high Q of the cavity results in a bandwidth, at the 3 db level, of approximately 900 kc, which, in turn, provides very sharp tuning as indicated by excellent meter response. At resonance, with a 1090 mc CW input signal, the wavemeter insertion loss is approximately 12 db. With a pulsed input signal having the pulse characteristics previously specified, an additional 6 db loss is incurred (18 db total insertion loss) due to the narrow bandwidth of the cavity.

The RF detector (A102) is a high frequency diode which responds to CW or pulsed RF and is forward biased to a region of good sensitivity.

The video amplifier consists of the three transistor stages Q101, Q102, and Q103 which are capacitively coupled to the detector output. This method of coupling limits the response of the 8905A to pulsed input signals only. The output of Q102 is connected to the front panel VIDEO OUT connector. The detected RF pulses are somewhat distorted in the amplifier due primarily to the time constants associated with the input coupling capacitor (C102) and capacitor C104 in the feedback network. Gain and stability of the amplifier are controlled by negative feedback from the emitter follower output stage (Q103) to the input stage (Q101). The amount of feedback is determined by the setting of R109. The emitter follower (Q103) provides the low impedance source necessary to drive the following pulse stretching circuitry.

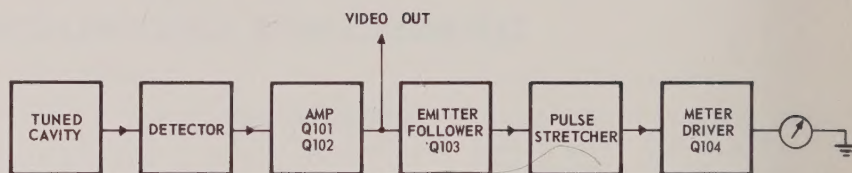


Figure 4. Block Diagram—8905A

The pulse stretcher is composed of capacitor C106, diode CR102, and resistor R115. The time constants of this circuit are such that the average base voltage of Q104, the Meter Driver, is made to vary relative to the input pulse amplitude. An optimum operating point for CR102 is fixed by the bias voltage determined by the resistive voltage divider (R113 and R114).

The Meter Driver stage, Q104, is

the current source for the indicating meter M101. A variable resistor (R116 METER SENS), in series with the meter, provides some control over the meter sensitivity.

The power supply is a full-wave rectifier type with a simple filter and employing a zener diode for voltage regulation. A dual primary in the power transformer permits operation from either a 115 volt or 230 volt, 50-60 cps source.

SECTION V

OPERATIONAL GUIDE

INTRODUCTION

The Operational Guide is a section devoted to practical application of the 8905A Wavemeter. This added information should assist in providing more accurate results as the capabilities and limitations of the instrument are expanded upon.

INPUT SIGNAL OF HIGHER THAN SPECIFIED PEAK POWER (>100 MW)

Should it be desired to measure the frequency of a signal of any peak power level in excess of the specified maximum (100 mw), it may be readily accomplished by inserting attenuators of the proper value between the source and the 8905A. The following table indicates the proper attenuation required for

several ranges of peak power.

Peak Power Input (Watts)	Attenuation (db)
250 - 1000	40
100 - 400	36
25 - 100	30
10 - 40	26
2.5 - 10	20
1.0 - 4	16
0.25 - 1	10
0.10 - 0.4	6

If the input signal is between 100 and 500 mw, it should only be necessary to reduce the meter sensitivity by adjusting the METER SENS control until an on-scale meter reading is obtained. It should be noted here that such an adjustment, while enabling the meter to indicate high

power signals, will have little effect upon the minimum power signal (25 mw) capable of being indicated; thus the power range over which the meter will properly indicate will have been increased.

VIDEO OUTPUT

The initial band restriction by the wavemeter cavity prior to detection will distort the shape of the input pulses to the 8905A. In addition, the time constants of the coupling and feedback networks in the video amplifier will further distort the demodulated pulses. Thus, this output is not adequate for making measurements of ATC pulse shapes and/or spacings. However, as previously de-

scribed it does provide a means of indicating proper tuning of the wavemeter when the signal being measured is of a very low level.

WAVEMETER ACCURACY

There are two sources of inaccuracies that may affect the wavemeter indication. The first is due to mechanical backlash in the drive mechanism and should not exceed 0.2 mc. The second source is in the resolution of the wavemeter cavity which will provide a repeatability, in the absence of backlash, in the order of ± 0.25 mc. ARINC Characteristic No. 532C (3-1-61) specifies that the interrogation frequency shall be 1090 ± 2.5 mc. The wavemeter absolute accuracy of ± 0.5 mc is therefore entirely adequate.

SECTION VI MAINTENANCE

GENERAL

The 8905A is an easy instrument to maintain. All parts are accessible after removal of the top, bottom, and side covers.

TROUBLE SHOOTING AND REPAIR

Voltage and Resistance Chart

The Voltage and Resistance Chart indicates normal operating conditions for the Wavemeter with no external equipment attached. Voltages were checked with a VTVM (-hp-410B). Resistance readings were made under the same conditions with the power disconnected. Some resistance readings were omitted as they have no significance; i.e., cases where electrolytic capacitors or semiconductor devices are connected in the circuit.

MECHANICAL DISASSEMBLY PROCEDURES

Top and Bottom Covers

1. Remove two screws at the rear of the instrument.
2. Slide cover toward the rear of the

instrument to disengage lip at front panel.

Right and Left Side Covers

Remove four screws from side covers. Top and bottom covers need not be removed.

Front Panel

1. Remove top, bottom, and left side covers.
2. Remove knob from FREQUENCY control.
3. From left side of instrument loosen four screws securing the side frame to the rear panel.
4. Remove balance of screws in the side frame.
5. Spring side frame away at front panel.
6. The front panel can now be moved to the left to detach the front panel from the right side frame.

The front panel will be restricted in movement by the connecting wires. Wires may be disconnected or components removed from the front panel accordingly.

Meter

It is recommended that the meter be removed after disassembly of the front panel.

Wavemeter Cavity

1. Remove the front panel (See Disassembly Procedure).
2. Disengage two BNC connectors (P102 and P103) from the wavemeter cavity.
3. Remove the four screws (from the top side of the 8905A) securing the wavemeter cavity to the chassis.

The wavemeter cavity complete with frequency dial can be removed through the front of the instrument.

Input Resistor (R101)—Wavemeter Cavity

1. Remove bottom and right side covers.
2. Disengage BNC connector from wavemeter.
3. The BNC fitting in the wavemeter can be removed by loosening the locknut and turning the fitting out of the threaded hole in the wavemeter cavity.
4. The resistor (R101) is soldered to the fitting as shown in Fig. 5. When replacing this resistor the leads should approximate the same position as on the original resistor.

After replacement refer to the adjustment procedure under Wavemeter Cavity Attenuation Adjustment.

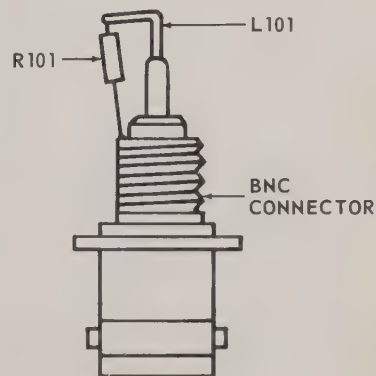


Figure 5.
Input Resistor (R101) Replacement

RF Detector Diode

1. Remove bottom cover.
2. Remove two screws securing detector diode assembly cover.
3. Diode can be removed from under cover.

When replacing diode observe polarity of original diode.

It should be noted that when replacing the cover on the diode assembly the insulator should be properly placed to be effective. The cover is actually one plate of capacitor (C101).

ADJUSTMENT AND CALIBRATION

Any tolerances listed in this section are the limits indicated by the Specifications in Section II. Factory adjustments are made to considerably closer tolerances. Field adjustments to closer than specified tolerances are possible if time and patience are used.

Recommended Equipment List¹

The following instruments are recommended for use in the adjustment and calibration of the 8905A Wavemeter. Pertinent information is given for substitution purposes.

1. -hp-431B Power Meter

Power Measurement Range: 1 μ W to 10 mw.

Accuracy: $\pm 3\%$ of full scale.

2. -hp-478A Thermistor Mount for use with the -hp-431B Power Meter.

3. -hp-175A Oscilloscope with dual trace plug-in head.

Frequency Response: 40 mc each channel.

Vertical Amplifier Sensitivity: 50 mv per cm.

4. -hp-410C VTVM

General purpose ac-dc voltmeter, dc ammeter, and ohmmeter.

Accuracy: $\pm 2\%$ of full scale.

5. -hp-8614A Signal Generator

Frequency Range: Range of Wavemeter (1070 to 1110 mc).

¹—If the 8905A Wavemeter is a part of the BRC Type 8925A DME/ATC Test Set, instruments on Test Set may be used for adjustment and calibration of the 8905A.

Frequency Accuracy: Should be monitored with a frequency counter.

Output: 10 dbm (10 mw).

Output Accuracy: Should be monitored with a power meter.

6. -hp-5245L Frequency Counter with -hp-5254A Frequency Converter.

Frequency Range: Range of Wavemeter (1070 to 1110 mc).

7. -hp-214A Pulse Generator. Capable of approximating ATC transmitter pulses.

Output: 100 volts into 50 ohms.

8. Variable, metered power source.

Output Range: 105 to 125 vac

9. Low VSWR 6db attenuator.

10. Low VSWR, double female, BNC adapter.

11. 150 ohm load.

Can be assembled using a UG-88/U BNC connector and a 150 ohm, $\pm 10\%$, 1 watt carbon composition resistor.

Power Supply

EQUIPMENT REQUIRED

1. -hp-410C VTVM or equivalent*.
2. Variable, metered, power source.
3. Oscilloscope (for measuring power supply ripple).

PRELIMINARY SETUP

Connect the 8905A to the power source set to 115 vac. Connect the VTVM (dc function) between the Red/Wht (+) and the Black (—) leads to the printed wiring board.

MEASUREMENT AND ADJUSTMENT

1. Voltage should be 24 ± 2 vdc.
2. Vary the ac input voltage to the 8905A over the range of 105 to 125 volts. Voltage reading on the VTVM should not vary more than ± 0.5 vdc.
3. Set power source to 115 vac. Connect the oscilloscope to the same point as the VTVM. Ripple at this point should be less than 18 mv p-p.

Amplifier Gain

EQUIPMENT REQUIRED

1. -hp-410C VTVM or equivalent*.

2. -hp-8614A Signal Generator or equivalent*.

3. -hp-214A Pulse Generator or equivalent*.

4. -hp-431B Power Meter with -hp-478A Thermistor Mount or equivalent*.

5. -hp-175A Oscilloscope or equivalent*.

PRELIMINARY SETUP

With the power off, connect the VTVM (ohmmeter function) across the METER SENS control (R116). Adjust the control for a reading of approximately 20,000 ohms. Amplifier gain control should be set to approximately mid-range.

ADJUSTMENT AND CHECK

1. With power turned on, adjust the 8905A input voltage to 115 vac.

2. Connect the pulse generator to the pulse input of the signal generator. Connect the power meter to the signal generator calibrated RF output.

The pulse generator should be set up to produce double pulses, .8 μ sec wide and 2 μ sec spacing between leading edges of the pulses. The PRF should be 250.

The signal generator should be set up as follows:

- a. LINE switch: ON
- b. FREQUENCY: 1090 mc
- c. PULSE button: Pushed in
- d. ALC button: Pushed in
- e. Adjust the output attenuator until the power meter reads +2 dbm. Disconnect the power meter.

3. Disconnect the BNC connector (P104) at the input of the diode detector of the wavemeter. Connect the signal generator to the diode detector input.

4. Connect one channel of the oscilloscope to the diode detector output. The second channel should be connected to the VIDEO OUTPUT (J105). Use the 150 ohm load.

5. Adjust the amplifier gain control (R109) such that the video output amplitude is 5, as read on the indicator meter. As viewed on the oscilloscope, the difference in gain be-

*See Recommended Equipment List under Adjustment and Calibration

tween the two channels should be of the order of 20.

6. Increase the PRF (Pulse Repetition Frequency) to 2500. Increase the signal generator output until the indicator meter reads full scale (10).

7. Decrease PRF to 250. The meter should read >8.5 .

8. Increase PRF to 2500. Meter should read full scale. Switch signal generator to CW. Using the power meter, measure signal generator output. Output should be $>+5$ dbm.

9. Switch signal generator back to pulse and reduce signal generator output until meter just begins to indicate above zero. Using power meter, measure signal generator output. Output should be <-7 dbm.

10. The difference in output between steps 8 and 9 should be >12 dbm.

If difference is less than 12 dbm, reduce the meter sensitivity control (R116) and repeat steps 5 through 9.

11. Reduce the signal generator output until pulse amplitude as displayed on the oscilloscope is .01 v peak. Using power meter, measure signal generator output. Output should be <-25 dbm.

Wavemeter Cavity Calibration

The frequency dial on the wavemeter cavity is calibrated separately for each wavemeter, thus, any attempt to adjust the internal capacitor could be damaging to the unit to the extent of requiring a new calibrated dial. After data is obtained, it might be determined that the dial calibration is off uniformly over the range of the dial. In this case only, the dial needs to be slipped with respect to the shaft of the wavemeter cavity.

Wavemeter Cavity Attenuation Adjustment

After replacement of input resistor R101, which forms part of L101, the insertion loss of the wavemeter cavity will require adjustment.

EQUIPMENT REQUIRED

1. -hp-8614A Signal Generator or equivalent*.

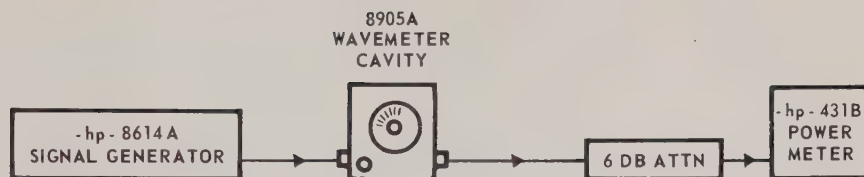


Figure 6. Wavemeter Cavity Attenuation Setup

2. -hp-431B Power Meter with 478A Thermistor Mount or equivalent*.

3. 6 db attenuator.

PRELIMINARY SETUP

1. Disconnect BNC connectors (P102 and P103) to wavemeter cavity. No power is required to 8905A wavemeter for this adjustment.

2. Connect signal generator, set at 1090 mc, to power meter through 6 db attenuator.

3. Increase output of signal generator until power meter reads 0 dbm.

4. Disconnect cables to insert the wavemeter between the signal generator and the 6 db attenuator as shown in Fig. 6.

MEASUREMENT AND ADJUSTMENT

The power meter should read -12 ± 1 dbm.

If insertion loss is incorrect, the attenuation can be adjusted at the BNC connector on the input to the wavemeter cavity. Loosen lock nut on connector and rotate connector for proper power meter reading.

**See Recommended Equipment List under Adjustment and Calibration*

SECTION VII

REPLACEMENT PARTS

GENERAL

Tables of replaceable electrical and mechanical parts for the 8905A are included in this section. Locations of these parts are given in Figs. 7 through 10. When ordering replacement parts, specify the BRC part number and the description given in the replacement parts tables.

See Section VI — Maintenance for detailed disassembly and assembly procedures and for the adjustment and/or calibration procedures required after component replacement.

For convenience in obtaining replacement parts locally, a List of Manufacturers is given below. This list is keyed into the tables of replaceable parts where the manufac-

turer's type numbers are also given. When a manufacturer's code and type number are not given, the part is a special part manufactured by or for BRC.

LIST OF MANUFACTURERS

Code	Manufacturer's Name		
0000U	Tower Mfg. Corp.	04062	Elmenco Products Co.
00656	Aerovox Corp.	04713	Motorola, Inc., Semicon- ductor Prod. Div.
01121	Allen Bradley Co.	12697	Clarostat Mfg. Co.
01295	Texas Instruments, Inc., Semiconductor Comp. Div.	42190	Muter Co.
02735	RCA, Semiconductor and Materials Div.	55026	Simpson Electric Co.
03508	GE, Semiconductor Products Dept.	56289	Sprague Electric Co.
		70903	Belden Mfg. Co.
		71450	CTS Corp.
		73734	Federal Screw Products Co.
		75915	Littelfuse, Inc.
		78553	Tinnerman Products, Inc.
		80031	Mepco, Div. of Sessions Clock Co.
		89462	Waldes Kohinoor, Inc.
		95712	Dage Electric Co., Inc.
		96341	Microwave Assoc.

TABLE OF REPLACEABLE ELECTRICAL PARTS

CIRCUIT SYMBOL	VALUE	DESCRIPTION	BRC PART NO.	MFG.	MFG'S TYPE NO.
A101		Wavemeter Assembly	08905-60003		
A102		Detector Assembly	08905-60004		
C101		Special (Part of A102)			
C102	.022 μ f	Capacitor, Fixed: $\pm 10\%$, 100V	0160-0684	04062	1DP-1-223
C103	.47 μ f	Capacitor, Fixed: $-20 +80\%$, 12V	0160-0736	56289	HY330
C104	.1 μ f	Capacitor, Fixed: $\pm 10\%$, 100V	0160-0865	04062	1DP-2-104
C105	.47 μ f	Same as C103			
C106	.1 μ f	Same as C104			
C107	10 μ f	Capacitor, Fixed: $-10 +25\%$, 6V	0180-0257	00656	PTT23
C108	.1 μ f	Same as C104			
C201, 202	40 μ f	Capacitor, Fixed: 150V	0180-0245	00656	PRS1470
CR101		Rectifier, Diode (Part of A102)	1900-0013	96341	MA424
CR102		Diode, Silicon: 1N660, 10V, 6MA	1901-0132	01295	1N660
CR201, 202		Diode, Silicon: 400PIV	1901-0028	02735	34532
		Diode, Silicon: 400PIV, 1N1763	1901-0126		
F201		Fuse, Cartridge: 1/8 A, 125V	2110-0064	75915	313.125
		Fuse, Cartridge: 1/16 A, 250V, SLO-BLO	2110-0040	75915	313.062
J101		Connector: BNC, SLO-BLO	1250-0241	95712	2684-3

CIRCUIT SYMBOL	VALUE	DESCRIPTION	BRC PART NO.	MFG.	MFG'S TYPE NO.
J102		Connector: BNC, Type UG-625A/U	1250-0211	95712	667-6
J103		Connector: BNC, Right Angle, Type UG-535/U (Part of A101)	1250-0210	95712	240-4
J104		Connector: BNC (Part of A102)	08905-20022		
J105		Connector: BNC	1250-0244	95712	9950-7
CR203		Diode, Zener: 1N3688A, 24V, 3/4W	1902-0179	04713	1N3688A
L101		Special [See Instructions under "Input Resistor (R101) — Wavemeter Cavity" in Section VI.]			
L102		Special			
M101		Meter	1120-0349	55026	1212C
P102-104		Connector: BNC, Type UG-88C/U	1250-0243	95712	100-813-3
P201		Connector, Receptacle: 3-prong male	1251-0148	0000U	H-1061 1G-3L
Q101, 102		Transistor: 2N2712, NPN, Silicon	1854-0029	03508	2N2712
Q103		Transistor	1851-0166		
Q104		Same as Q101			
R101	51 Ω	Resistor, Fixed: $\pm 5\%$, 1/10W	0674-5105	01121	TR5105
R102	50 Ω	Resistor, Fixed: $\pm 1\%$, 1/4W	0724-0058	80031	C-10
R103	10K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-1035	01121	EB1035
R104	51 Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-5105	01121	EB5105
R105	1.2K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-1225	01121	EB1225
R106	3.3K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-3325	01121	EB3325
R107	22K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-2235	01121	EB2235
R108	68K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-6835	01121	EB6835
R109	5K Ω	Resistor, Variable: $\pm 30\%$, 1/3W	2100-0091	71450	UPE70(SPL)
R110	1K Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-1025	01121	EB1025
R111	180 Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-1815	01121	EB1815
R112	1K Ω	Same as R110			
R113	390 Ω	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-3915	01121	EB3915
R114	22K Ω	Same as R107			
R115	1 Meg	Resistor, Fixed: $\pm 5\%$, 1/2W	0686-1055	01121	EB1055
R116	100K Ω	Resistor, Variable: $\pm 10\%$	2100-0472	01121	Type J
R201, 202	2.7K Ω	Resistor, Fixed: $\pm 5\%$, 2W	0692-2725	01121	HB2725
S201		Switch, Rotary: SPST, 250V, 3A	3100-0843	12697	Series EE Type 10
S202		Switch, Snap Slide	3101-0033	42190	4633
T201		Transformer, Power	9100-0271		
W201		Power Cord	8120-0078	70903	KH-4147
Z101		Printed Circuit Board Assembly (with components)—See Mechanical Parts List for printed circuit board only.	08905-60001		

TABLE OF REPLACEABLE MECHANICAL PARTS

BRC PART NO.	DESCRIPTION	QTY. PER UNIT	MFG. CODE	MFG'S PART NO.
0370-0028	Knob	1		
0370-0077	Knob	1		
0400-0002	Grommet	1	73734	656
0510-0221	Nut, Retained (Top & Bottom Covers)	4	78553	C8020-632-4
0510-0228	Ring, Retaining (Used on Wavemeter Dial Shaft)	2	89462	5133-25
1400-0084	Holder, Fuse: Extract Post Type	1	75915	342014
1410-0181	Gear: 56T	1		
1490-0032	Stand, Half Module	1		
5040-0700	Hinge, Tilt Stand	2		
5060-0728	Foot Assembly: Half Module	2		
00202-00041	Plug Button	1		
00230-60041	Terminal Board Assembly	2		
08905-20004	Fiducial	1		
08905-60007	Printed Circuit Board (Less Components)	1		
08905-60010	Split Gear Assembly	1		
08905-80003	Insulator, Detector	1		


Figure 7. 8905A—Front View

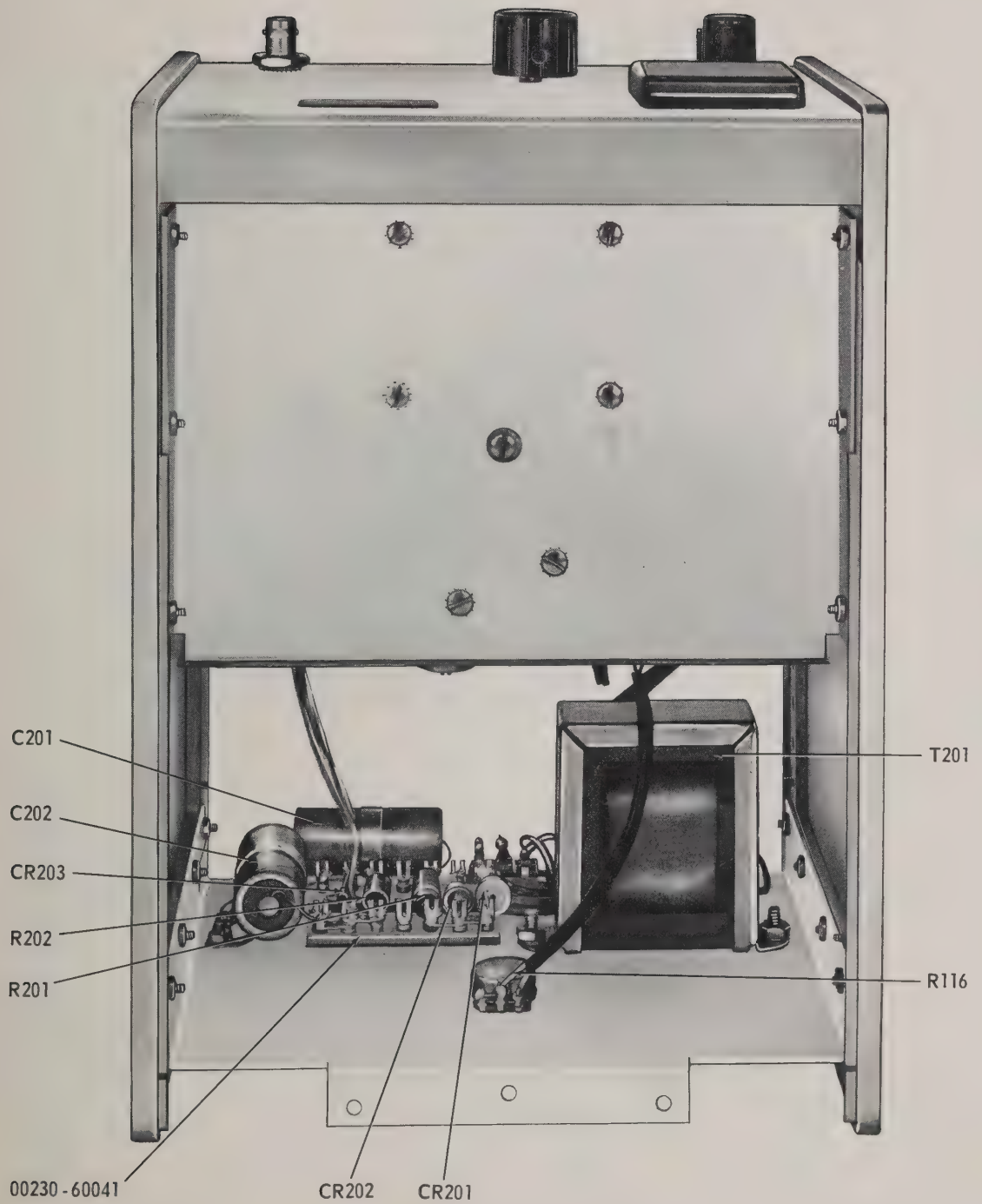


Figure 8. 8905A—Top View

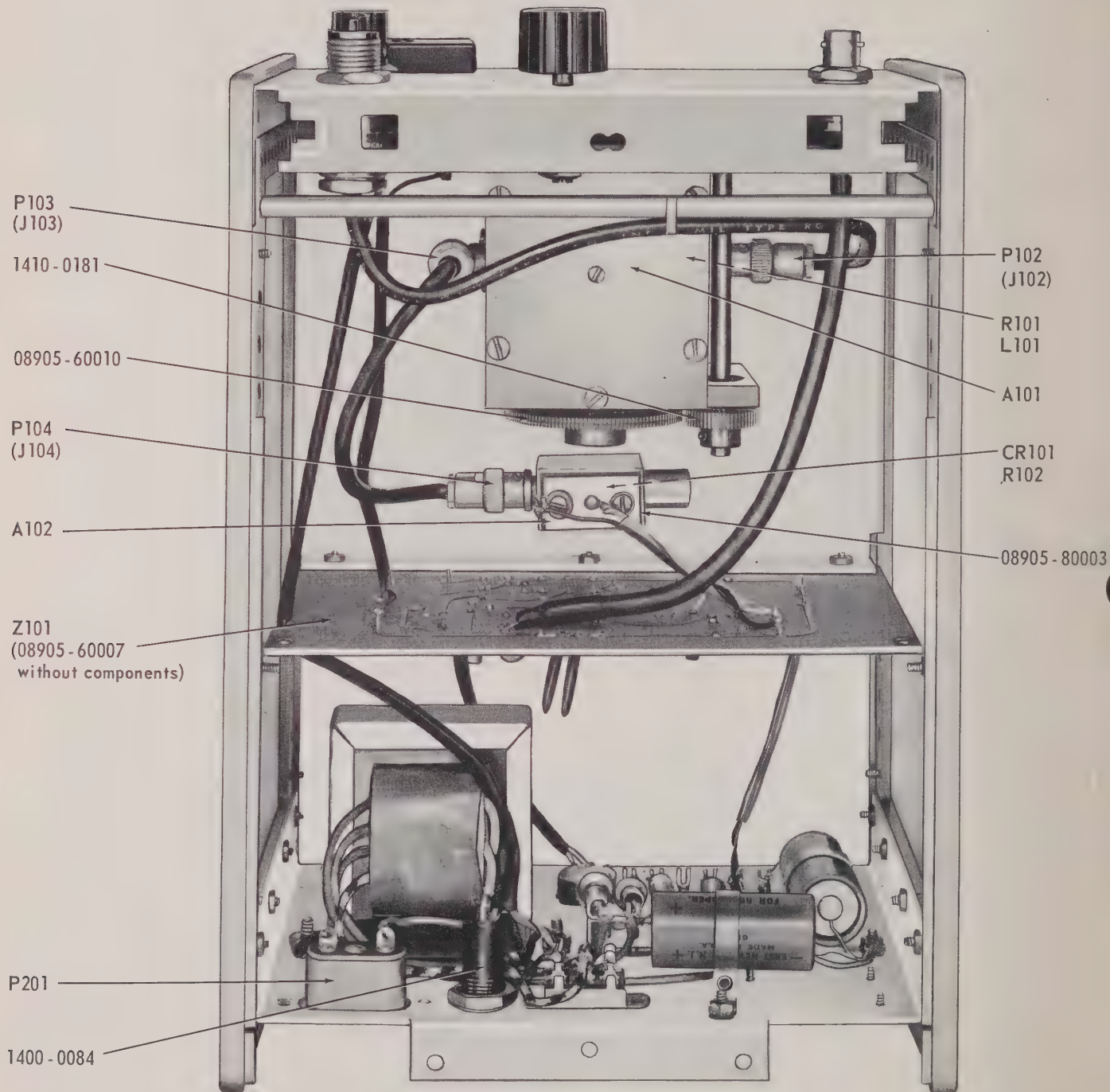


Figure 9. 8905A—Bottom View

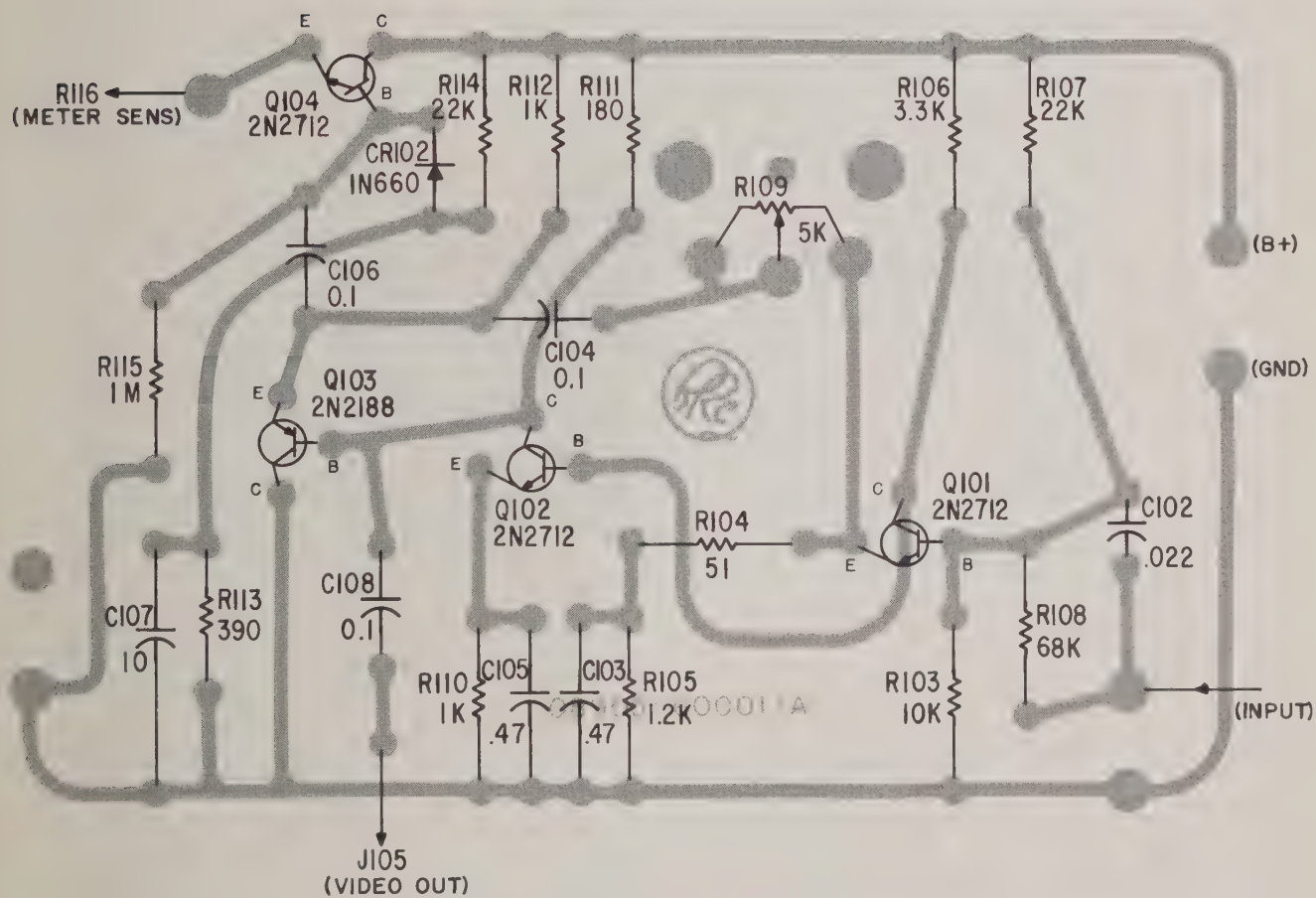


Figure 10. 8905A—Printed Circuit Board (Z101)

SCHEMATIC REFERENCE	VOLTAGE*	RESISTANCE*
A	.2 vdc	N/S
B	7 vdc	7.5K Ω
C	6.5 vdc	1.2K Ω
D	8.8 vdc	3K Ω
E	8.2 vdc	1K Ω
F	24 vdc	N/S
G	24.2 vdc	N/S
H	.46 vdc	.400 Ω
I	.26 vdc	N/S
J	0	see Note 4
K	25.5 vdc	N/S
L	130 vdc	N/S

NOTES

1. All voltages and resistances use chassis ground as reference.
2. N/S — Not Significant.
3. * — Typical voltages and resistances.
4. Do not measure resistance, as internal battery voltage of ohmeter could damage meter.

Figure 11. Voltage and Resistance Chart

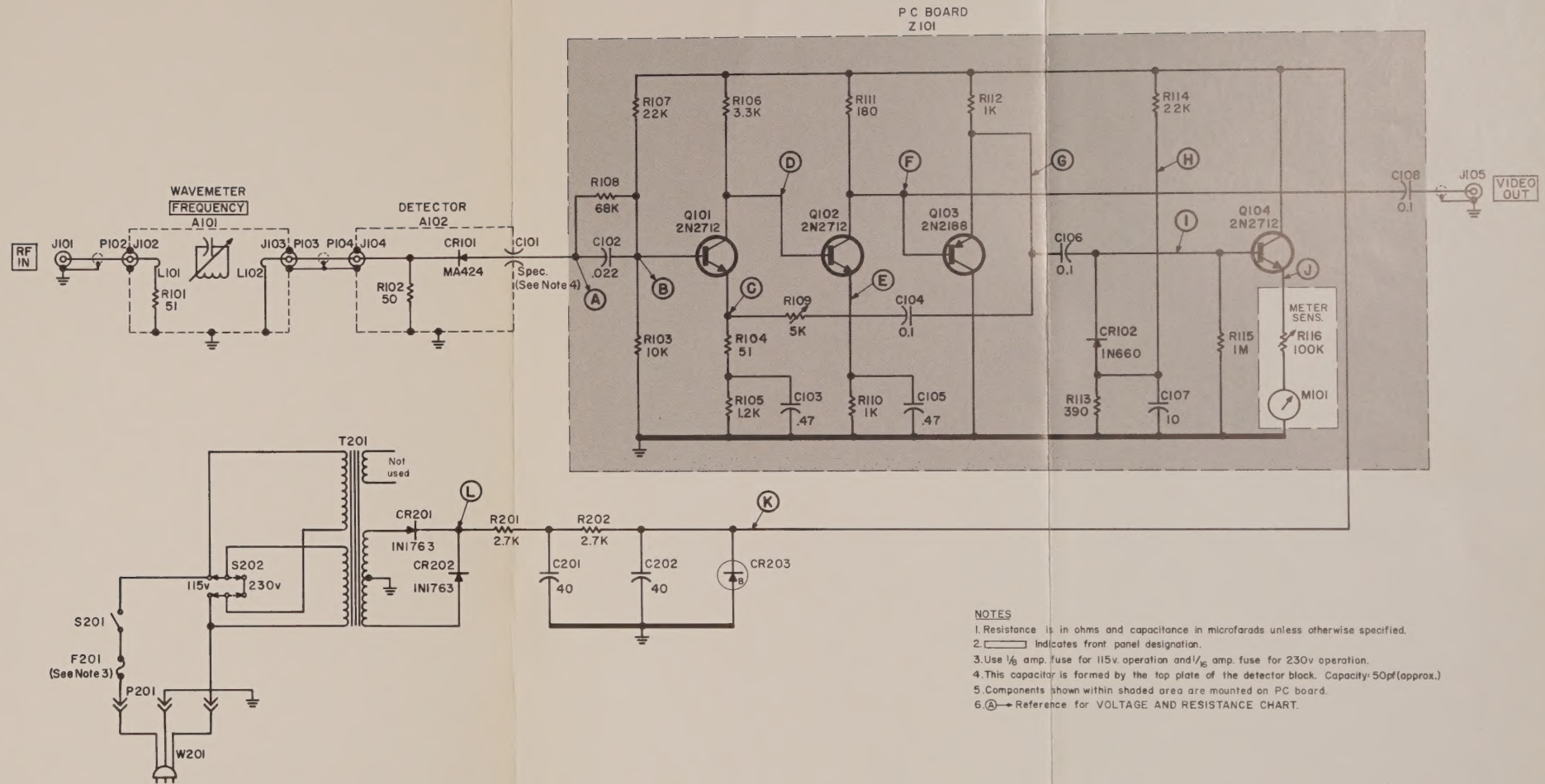


Figure 12. 8905A—Schematic

MP MASTER



MA25133